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The Relation of the Fertilizer Industry to the Agricultural and Industrial Development of the Country

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BY W. H. BOWKER

Away back, more years than I care to recall, when a boy on the farm, I helped my father drop "phosphate" in the hill to give corn a start. I was told that phosphate made corn grow because it possessed certain chemical or mystic properties; but from a study of the label and of the manufacturer's pamphlet, little was revealed to me. It was called "phosphate" for short, but it was branded "Nitrogenous Superphosphate of Lime." That name was a poser. As expected, it had its psychological effect on the imagination. I stood in gaping wonder at it. The phosphate gave the corn a start all right. That phenomenon and the name gave me a start. No prestidigitator ever aroused my curiosity more. I wondered what nitrogenous superphosphate could possibly be and just why it gave corn a start. I am still wondering, for as yet science has not revealed the whole secret.

About this time a professor of chemistry in Amherst College came to the adjoining town and delivered a brilliant lecture on the chemistry of common salt. That opened my eyes and led me to think I wanted to know something about chemistry; so when this same brilliant professor, Col. William S. Clark, became president of the Massachusetts Agricultural College (1867), I sent for a catalog, wherein I saw that chemistry was given an important place in the curriculum. I then decided, against the wishes of my family, to go to the agricultural college.

There I came under the instruction of an able German chemist, Dr. Charles Anthony Goessmann; there not only was I taught the first principles of chemistry, but my attention was particularly directed to chemistry as applied to agriculture, and the composition of plant foods. I learned that fertility or plant food was the cornerstone of agriculture, and that without it agriculture, as well as all other industries and activities, would perish.

I was told that the Germans used enormous quantities of commercial plant foods to build up and sustain their agriculture, and that the fertilizer industry in Europe, while then in its infancy, was fostered and encouraged by the Government and by economists. "Some day," remarked the German professor, "the industry will be fostered and encouraged in this country as it is abroad."

His interesting and prophetic lectures fired me with zeal to study chemistry with the view of some time entering the fertilizer business. Two years after graduation, in 1873, at twenty-three years of age, in company with a classmate I engaged in the manufacture of fertilizers.

At that time there was much opposition to the use of "artificial manures," the opponents, like those of today, urging that they were stimulants—that they would ruin the land and the farmer who used them. Nevertheless farmers persisted in their use, for they had discovered that they gave crops a start, that they hastened maturity and improved quality. Remember, in those days fertilizers were principally dissolved bone, carrying about two per cent. of nitrogen, ten per cent. of soluble phosphoric acid and *no* potash. The wise teachers of chemistry—Johnson, Goessmann, Stockbridge and others—knew that the reason why they hastened maturity and improved quality was that they possessed the needed plant food elements in easily assimilable forms. Being true scientists and wise counselors, they urged their use. They also recognized the need of proper inspection, and moved for stringent inspection laws which would weed out the fakes and fakers and protect both buyer and seller. These laws have been a great help to the industry. We should heartily support them.

The Growth of the Industry—The Deficiencies

We have no accurate data of the amount of fertilizers sold in this country prior to the enactment of inspection laws in 1874 and later; but it is believed that not over half a million tons were sold in the entire country—most of it in the South for cotton. Today fully seven and one-half million tons are sold in the country, chiefly in the Atlantic seaboard States—a marvelous growth in forty years.

Why this growth? We know, if the public does not generally know, that fertilizers are food, and food rightly used never hurt anything. Men and animals live on vegetation, and vegetation lives on the soil, the air and the sunshine. It is obvious, then, if man would live and thrive he must utilize in the greatest possible degree the natural agencies placed at his disposal. To that end he must supply deficiencies in the soil, and remedy defects in his methods of cultivation.

The three chief elements of plant nutrition are nitrogen, phosphorus and potash. A chemical analysis however, shows that there is usually an abundance of these in most soils, often-times enough for centuries of cropping; yet such soils may be practically barren, because these elements, although they may be present in abundance, are not soluble in water, for it is known that all plants require their mineral food to be in solution or capable of soon becoming soluble. *Therefore the deficiencies which man must supply are not, as a rule, deficiencies in total or potential fertility, but deficiencies in water soluble or available fertility.*

Malthus and His Theory

Malthus, an English economist, declared in 1800 that "population, when unchecked, increases in a geometrical ratio; subsistence increases only in an arithmetical ratio." Later he modified this statement when discussing the voluntary and positive checks to increase in population. Of course he was bitterly denounced. His theory was called a "poisonous novelty," but economists appear now to be coming to his defense. Dr. Warren S. Thompson, in his recent thesis on "Malthusianism," says:

"Malthus was essentially correct in his statement of the law of population. When we examine individual countries we find that population increases when food increases (with the exception of France). For the great majority of people of the Western world the pressure upon *means of subsistence* is the determining factor in the size of the family."

When Malthus proclaimed his theory the world did not know of the enormous natural sources of fertility. It did not know of the millions of tons of nitrogen in coal, of the vast reservoir of nitrogen in the atmosphere. It did not know of the extensive deposits of potash and phosphate; it had little knowledge of soil and plant chemistry; it had never heard of soil bacteria and the great part which they are destined to perform in feeding the world. The fertilizer industry, whose business it is to marshal and correlate all these sources and forces, had not sprung into existence.

It must be borne in mind that during aeons of time some form of vegetable and animal life has persisted on this earth; but man, the highest order, has come along and upset Nature's plans, or the balance, and now he has to restore it. The fertilizer industry was evolved to help man restore the balance; hence it is searching the world over for all sorts and conditions of plant food.

Sources of Fertility—The Nitrogen in Coal

The framework or bone structure of all living things is phosphate of lime. We are finding an abundance of it in unexpected places. Another fundamental element is potash. Nature has furnished an almost inexhaustible supply in Germany, but the world will not be content with one source.

Nitrogen, at present the most costly element of fertility, is in great abundance everywhere. It is estimated that there are 35,000 tons of atmospheric nitrogen over every square acre of the earth; but before this great reservoir is tapped to any extent, the nitrogen in by-product materials will first be utilized. This is inevitable, for I cannot conceive that a process will be discovered which will prove cheap enough to take nitrogen from the air when it can be obtained as a by-product of essential industries.

We have now reached the limit of many of these by-products derived from the soil, such as bone, meat tankages and seed meals, but we have not begun to touch the great source of nitrogen in our coals. When we come to consider this source the statistics are assuring.

According to Government reports the United States mined in 1913 a grand total of 570,000,000 tons of coal. Taking the statistics of the twelve leading coal-producing States as a guide, it is safe to say that this coal averaged about 26.6 pounds of nitrogen to the ton— $1\frac{1}{3}$ per cent., or nearly as much as a 2-8-2 grade of fertilizer contains. This is equivalent in round figures to 7,500,000 tons of nitrogen, or enough nitrogen to give 30 pounds to each improved acre of land in the United States.

Take, for example, the State of Illinois. In 1913 that State mined almost 62,000,000 tons of coal. The coals of Illinois average about 21 pounds of nitrogen to the ton; thus there were mined in Illinois about 650,000 tons of nitrogen, which is equivalent to 45 pounds to each acre of improved land in that State. *This is twice as much nitrogen as all the cereal grains grown in Illinois require.* Even the Dakota lignites contain 14 pounds of nitrogen to the ton, which should be utilized on Dakota wheat fields.

It would be absurd to assume that all the nitrogen in coal is recoverable; probably only a fraction can be saved. England and Germany are recovering a very considerable amount from the soft coals which they consume; but it is obvious that we should recover as much as it is possible to recover, and that, *when recovered, we should encourage its use.*

At present there are two feasible ways of recovering this nitrogen. One is in the manufacture of coke and illuminating gas. The other is in the production of producer gas for power purposes by processes (notably the Mond process) which conserve the

nitrogen in the form of sulphate of ammonia, the tar and all the by-products of tar—and they are many and valuable. Approximately 200,000 tons of sulphate of ammonia were produced in the United States in 1913, chiefly from coal, conserving 40,000 tons of nitrogen, or enough to supply nearly one-half of the nitrogen required for the staple crops grown in New England. The value of the nitrogen in the coal alone, at 10 cents a pound, or half the present retail price, is equal to the value of the coal at the mines, or \$2.50 a ton, leaving the gas, tar and its distillates to pay expenses and profit.

Think what it would mean to a great agricultural and industrial State like Illinois, if, in addition to the gas for power purposes, some considerable part of the nitrogen in its coal could be conserved for corn production, also the pitch for improving its highways and byways. At present about 2,500 tons of nitrogen are conserved from coal in Illinois, most of it within fifty miles of Chicago; but little of it, however, is used on Illinois soils.

Cheaper Nitrogen an Outcome of the War

Sir William Crookes, the English chemist and economist, declares that the food supply of the world is dependent on the supply of nitrogen, and predicts that, as the nitrate beds of Chile will soon be exhausted, we must find other sources of nitrogen to sustain the world.

One of the beneficent outcomes of the present war (and bad as it is, I am sure that good will come of it) may be cheaper nitrogen. One of the essential ingredients of destructive explosives is nitrogen. Chile saltpeter has been the chief chemical source. While the ports of Germany appear to be closed, she does not seem to be disturbed about it. It is evident that the Teutons are getting nitrogen for their explosives and their agriculture from some other source than Chilean nitrate, probably from coal and from the air by a new process. After the war is over the world will have the benefit of their discoveries. It will be remembered that beet sugar was an outcome of the Napoleonic wars.

One section which undoubtedly would benefit is the cereal belt of our own country, where instead of 14 bushels of wheat per acre we might see 28 bushels per acre; instead of 29 bushels of corn we might witness 58 bushels per acre, *and it is largely a question of cheaper nitrogen*. It is estimated that already the world outside of Germany is obtaining fully 50,000 tons of nitrogen annually from the air for agricultural and industrial uses by new processes put into operation since 1906.

It is obvious that the utilization of all by-product forms of nitrogen, including municipal wastes, should be encouraged by every one and especially by agricultural chemists and agrono-

mists. If, however, they discourage their use, as is being done in some quarters, then their utilization will be retarded.

Some Western Opposition

For example, the Illinois Farmers Institute, a State-supported institution, has officially gone on record as opposed to our National Fertilizer Association because it had the temerity to organize and support a propaganda for the judicious use of commercial plant foods, including nitrogen. This Institute dogmatically warns

"editors, farmers, bankers and others against accepting the teachings of, or assisting in any way, this association or any other organization whose teachings are *in conflict with the facts* established by the Illinois State Experiment Station."

Now our propaganda may be open to criticism—I dare say it is, for it is human and therefore fallible—but there is one thing it has not done, *it has not claimed to be infallible*. Whatever it has put out has had the warrant of experience and the backing of scientifically conducted experiments the world over. In my judgment no State-supported organization or educational institution can afford to go out of its way to deliberately misrepresent any industry, especially an industry whose business it is to gather and render available all sorts and conditions of fertility, so basic and needful everywhere, and as much so in Illinois as in any other State of the Union.

The East versus the West

Again: in Circular 181, page 6, of the Illinois Experiment Station (1915), Dr. Cyril G. Hopkins, Agronomist of the Illinois University, in good and regular standing, writes as follows:

"A boy found a drunkard lying on the sidewalk, and he called through the saloon door to the barkeeper that his sign had fallen down. *Through lack of fundamental knowledge*, the general farmer of the East has been led to depend upon mixed commercial fertilizers, and ten million acres once classed as improved farm land, but now agriculturally abandoned, represent the sign for Illinois farmers to look upon before adopting the fertilizer system now so extensively advertised in the Middle West. The commercial fertilizer interests, especially Eastern fertilizer manufacturers, *after having sucked the life-blood out of Eastern agriculture*, now seek new worlds to conquer, attracted by the agricultural earnings of the corn belt."

The above reminds one of "Ten Nights in a Bar Room," where the awful example of the drunkard is pictured to frighten innocent boys on the sidewalk who may be looking in. The awful example of the drunken, effete East is held up to the virile "dry" West. Well, if the West with its average of 29 bushels of corn per acre can stand it, the East can stand it with its average of 44 bushels per acre. If Eastern fertilizer manufacturers have "sucked the life-blood out of Eastern agriculture" by utilizing nitrogen from coal and nitrates from Chile and more recently from the air, then Eastern station directors, chemists and agronomists have been accessories to the crime, since for years they have encouraged it. And how about the Western agricultural press which is printing the lurid advertisements of these blood-suckers, written in the life-blood of Eastern farmers? Is it not *particeps criminis*?

It is part of our business to take bone and convert it into bone charcoal, which we sell for refining purposes. After the refiners are through with it, it finds its way into baking powder for making bread, or into fertilizers in the shape of dissolved bone black, or "superphosphate" for growing wheat; thus it gets into bread whichever way it goes. In doing this we save the grease for soap-making and the nitrogen for grain-growing, but according to Illinois agricultural bulletins, by some chemical necromancy we have deliberately converted the nitrogen and the phosphate of the bone into "soil stimulants" which is a crime, and the men who do it, in the opinion of Dr. Hopkins, are blood suckers.

Dr. T. F. Hunt, formerly Director of the Pennsylvania Experiment Station, now Director of the California Station, in a recent issue of the "American Agriculturist," writes:

"A soil can be kept fertile indefinitely by the use of chemical fertilizers. . . . For over sixty years large yields of wheat have been raised annually on the same land at Rothamsted, England, by the application of nitrogen, phosphoric acid and potash. The soil contained plenty of lime. When properly used commercial fertilizers *do not* injure the soil."

The commercial fertilizers to which Dr. Hunt refers have long been composed of packing house waste, the very bone and sinew of Middle West soils. We have been wont to think that it was poor economy on the part of the West to allow it to be shipped away. But it now appears that she has been very wise, for if she had kept her blood and bone tankage at home and used it on her soils it would have ruined them. The East took it and used it; hence, according to Dr. Hopkins, her abandoned farms.

New England "Abandoned Farms"

But a word about these New England "abandoned farms." Would it not be fair to state that, notwithstanding the ten million acres (?) abandoned in New England (actually only 879,499 acres abandoned since 1889), she is producing \$46,000,000 *more* in value of farm crops than she did when the 879,499 acres were included. According to the census, Massachusetts produces in crops in round figures \$41 per acre as against Illinois' \$17 per acre, or almost two and one-half times as much. She stands at the top of the list. *Why? Because she has learned how to make one acre do the work of two.*

Would it not also be fair to state that most of the farms which have been abandoned in New England are the hilly, rocky farms or sandy plains, which should never have been cleared, and which would not have been cleared if our forefathers had known of the fertile prairies west of the Ohio? It might also be well to state that these so-called deserted farms have reverted to forests and are yielding annually in lumber and wood (which are perfectly good money crops) as much per acre as some of the Illinois farms.

The mistake New England made was that she did not take *more* of the blood, bone and tankage of the West, and send less of her real life-blood in young manhood to develop the West.

What Other Authorities Say

The State of Connecticut was the first large user of fertilizer in this country, and with the exception of Maine she is still the largest user per acre on staple crops such as corn, potatoes, tobacco, etc. Dr. Jenkins, who has been connected with the Connecticut Experiment Station, either as chemist or director, for more than thirty years, recently endorsed the Maine complete formula for potatoes, the outgrowth of Director Jordan's and Director Woods' experiments and observations. At a recent convention in Hartford, Dr. Jenkins made the following statement:

"Fertilizers for most soils and crops are necessary for the highest production and, when rightly used, for the highest profitable production."

Director Thorne of the Ohio Experiment Station has recently summed up in Circular 144 an instructive series of experiments covering twenty years with fertilizers. They show that *complete, available* mixtures, containing nitrogen, phosphorus and potash, gave the largest yields of corn, oats and wheat in five-year rotations, including timothy and clover. They show a gain over check plats where nothing was applied of 57 per cent. in oats, 60 per cent. in corn, 126 per cent. in wheat, with the soil practically holding its own; in fact in the case of corn, where the best

balanced mixture was used, there was a gain of four bushels an acre in the last five-year period over the first five-year period. We might quote similar convincing experiments elsewhere, if time permitted. Let me, however, refer to one more interesting experiment in the Middle West.

An Illinois Experiment and the Illinois System

Bulletin 176 of the Illinois University on the "Use of Commercial Fertilizers in Growing Carnations," concludes:

" . . . On the brown silt loam of the corn belt area of Illinois, nitrogenous fertilizers have produced a consistent increase in production. . . . There are indications that acid phosphate if used with nitrogenous fertilizers will cause a still further increase in production and an improvement in quality as well. The quality of flowers produced by culture with commercial fertilizers as measured by size of flowers, length of stem, keeping qualities, etc., is equal to that of those grown with manure. . . . Injury from over-feeding results from the excessive use of potash and nitrogen in the form of sulphate of potash and dried blood. The use of large quantities of acid phosphate, however, seems to improve the quality of the flowers and to increase their number."

All of which is extremely interesting, for the same principles apply in the growth of cereals. It is also interesting to note that acid phosphate was used in these experiments, and not raw phosphate.

How this ever got by the censor of the Illinois Station is beyond me. Before the Station knows it, somebody will be tempting pansies with commercial fertilizers, and then some one will "try-a-bag" on potatoes, and it is but a short step from pinks, pansies and potatoes to corn and wheat. It will not, however, be the first time in the history of commercial manures that florists and horticulturists have pointed the way for the staple crop farmer; but it will be a distinct loss if the great agricultural and industrial interests of the West must wait on the discoveries of the florist and horticulturist.

The so-called "Illinois system of permanent agriculture" of lime, raw phosphate and legumes, which these officials are advocating in place of commercial fertilizers may be good for certain limited sections, but in general practice it will be found too slow for present needs and conditions. Let me say, however, that the fertilizer industry favors any system, the Illinois or any other, which will benefit agriculture; but it stands to reason that, as

Nature has deposited all over the world an abundance of plant food, man should utilize it *whenever* and *wherever* he can to advantage.

A Scare-Head Propaganda

It is pure quackery to call these things which Nature has created for man's use "soil stimulants" or "patent soil medicines" *after* they have been rendered available by the touch of chemistry. The scientific world knows that, by mining and rendering raw phosphate soluble, we are not converting it into a soil stimulant; we are converting it into a form which in some way encourages early root development and promotes bacterial activity in the soil. By mining and refining potash we are not converting it into a stimulant, but into a soluble, active salt—an essential plant food. By conserving the nitrogen in all the by-products of industry, such as tankages, seed meals, industrial and municipal wastes, we are not converting it into a plant stimulant, but into assimilable food for soil upbuilding and crop production. Further, when we conserve the nitrogen of coal or abstract it from the air for agricultural use, we are doing just what Sir William Crookes said must be done if the world is to be fed.

It is an economic blunder, if not a more serious thing, to attempt to frighten farmers into not using fertilizers by likening them to alcohol. It is a matter calling for criticism, if not for condemnation, for men in Government employ, using Federal and State funds and the prestige of a great university, to carry on this sort of scare-head propaganda—a propaganda which in its larger aspects is unscientific and directly opposed to the agricultural and industrial development of the country.

I have discussed at some length the opposition of a few agricultural officials to the use of commercial fertilizers, because I feel that in their official capacity they are standing in the way of agricultural progress in the Middle West.

Will It Pay to Use Fertilizers

Whether or not artificial fertilizers are plant food is no longer a debatable question. That was settled years ago by Liebig, Lawes and other great experimenters. Whether or not it is profitable to use them in all places and on all crops will always be a debatable question; but it is not one which the chemist or agronomist can settle for each farmer, for it is an individual and local problem. The Government might as well attempt to determine what the farmer shall eat or wear, or whom he shall marry, as to say whether or not it is profitable for him to use fertilizers. The Government can help him in many ways; but when it comes to the matter of what will pay, only the farmer can

determine that for himself, by experiment on his own soils and crops. B may be a better crop grower than A, but A may be a better business man and thus realize a greater profit. We cannot eliminate the personal equation in farm operations.

As to the matter of profit, with their present limited experience in the use of fertilizers it may not *now* pay Middle West farmers to use them in sufficient quantity to meet *all* crop needs. Assuming that such use will not be profitable, it does not follow that it will not pay individual farmers to use fertilizers to *supplement* any system of agriculture which they may adopt in order to *improve quality, hasten maturity and insure results*. That alone is enough to justify their use in the Middle West today.

The Loss from Soft Grains

Take, for example, the soft and immature grains which are produced in the Middle West. If these could be lessened by half and the quality improved, what a vast saving would be effected!

The cause of these soft grains is no doubt inadequate or improper feeding at the crucial time. The judicious use of commercial plant foods will help correct this condition. I am happy to state that the Middle West is already using a considerable quantity for this purpose—probably more than half a million tons annually. It should, for various reasons, use a great deal more. For example, Iowa should use on corn and grass as much as Georgia uses on corn and cotton, which is a million and a quarter tons annually.

Commercial fertilizers have come to stay, as much so as farm machinery or automobiles. Therefore would it not be wiser for agricultural teachers to seek to direct their use rather than to dogmatically oppose their use? I am told that a number of prominent teachers of agriculture in the Middle West are successfully using fertilizers *on their own farms* to quickly bring them to a high state of productiveness, but who in public discourage their use; one reason given is that they fear it will lead farmers to abandon the keeping of live stock. Is this quite fair to the farmers? What is good for the teachers to use should also be good for the farmers to use. In the East we can point to scores of cases where farmers have used fertilizers to bring up their farms quickly and who are now keeping so much stock that they do not need to use them, except to start crops or to hasten maturity or to improve quality. Why not encourage farmers to experiment for themselves with fertilizers on their own crops and soils to see what they can do to reduce the amount of soft grains, or to bring up their farms quickly to a higher state of productiveness?

The Billion Bushel Wheat Crop—What It Takes From the Soil

We are proud of the fact that we shall have approximately a billion-bushel wheat crop in 1915. We are glad that we are able to help feed nations across the sea, now at war, to a greater extent than ever before. A bushel of wheat of 60 pounds contains two pounds of plant food; that is, nitrogen, potash and phosphoric acid (in money value about twenty cents a bushel), thus do we realize that a billion bushels of wheat contain approximately 1,000,000 tons of plant food, of which 575,000 tons are nitrogen? Do we realize that we exported in the last twelve months, ending June 30th, in the shape of cereals over eighty million dollars' worth of plant food? We received back an equivalent, but how much of it shall we put back into the soil in the shape of plant food? As a matter of fact, but an infinitesimal amount in the cereal belt.

How long can we continue this soil mining (Henry Wallace calls it soil robbery) and remain the granary of the world? How long can we continue to upset the balance in this way and remain a prosperous nation?

In a recent interview M. Hugues Le Roux, editor of a leading journal in France, on a diplomatic mission to this country, said:

"Farms in America are laid out on a grand scale, for men seek to draw from Nature the most she possesses, giving the least possible nourishment in return. What a pity! Some day the soil will grow tired. . . . In France, where cultivation has been going on for centuries, *la terre* (the soil) is well taken care of. We do not always ask of her. She is fed like a cow. She has a place within the farmhouse. She is a somebody. Her well-being is of concern to the whole family—to the nation as a family or government."

Restoring the Balance—Other Important Factors

Important as our industry is and will be in helping to restore the balance, we must remember that we are only one factor. Other important factors will be at work, such as better cultivation with better implements, better seed, better drainage, rotation of crops and the growing of leguminous crops. All will cooperate to help restore the balance.

Many think that irrigation will be the most important factor in restoring the balance. It is true that water is the largest factor in crop production, but virgin irrigated lands, after a time, will need fertilizers as much, if not more than the unirrigated, for

big crops, as the result of irrigation, will make correspondingly big drafts on the available fertility of the soil.

I am an optimist. Italy, like France, has been farmed for centuries and is still a productive country. Germany has been farmed intensively a hundred years and is now producing 88 per cent. of the foodstuffs required by her sixty-five million population. Secretary Houston states that only 40 per cent. of the tillable land in the United States is under cultivation. When the remaining 60 per cent. is brought under the plow, or, better still, when the whole is made to produce by intensive methods twice as much as it produces now (and Western Europe is an example of what can be done) we shall have food enough and to spare.

Not Production But Distribution

It seems to me the pressing problem is not of production, but of distribution. The excess of farm products in certain sections, and the scarcity in others, as, for example, twenty-five million bushels of potatoes in Aroostook County and an apparent scarcity in New York City, resulting in potatoes being thrown away at times in Maine and still selling at a dollar a bushel in New York, is a striking illustration. When the facilities of distribution and exchange are improved this condition should be remedied, and when remedied everyone should be able to afford three square meals in our great cities, and the farmer should get his fair share of the dollar. If he does get his fair share there will be little question of food supply.

Sir William Crookes, in his President's Address to the British Association for the Advancement of Science (1898), said:

"It is the chemist who must come to the rescue. It is through the laboratory that starvation may ultimately be turned into plenty. . . . The future can take care of itself. . . . In days to come when the demand may overtake supply we may safely leave our successors to grapple with the stupendous food problem."

With untold millions of acres of the earth's surface still unknown to the plow, and with scientific research in its infancy, world starvation is only a remote possibility even if there were no voluntary and positive checks to the increase of population, as there have been and always will be.

Therefore, are you surprised that I am an optimist and do you wonder that I am proud of our industry and the place it holds as a co-worker with the farmer in the agricultural and industrial development of our country?

Improvements in the Industry

I am asked by President Jarecki to add a word about improvements in the industry. The constitution of the National Fertilizer Association sets forth this object: "To procure and disseminate useful knowledge pertaining to the scientific development of agriculture . . . the aim being to improve and facilitate the increase of soil production." Let us carry out this object to the letter. It is perfectly legitimate for the industry to organize a propaganda to further the use of its wares, as legitimate as for farmers to organize to promote the sale of their products, but in its literature it should treat the subject of fertility and its use on broad and economic grounds. It should also remember that the chemistry of fertilizers to the layman is extremely technical and therefore needs simplification. We must reiterate in the simplest language that fertilizers are *food*. Many farmers, encouraged by demagogues, still think that they are stimulants and not foods. We must at all times and in every place combat that idea. We must impress upon them that well-made fertilizers are prepared food for plants as milk is food for animals.

Uniform Directions—Uniform Laws

As an industry we should have fairly uniform directions, for I am satisfied that many failures are due to misapplication. To that end, if permissible under State laws, I would wire to each sack a tag giving explicit directions. We must not be selfish in this matter, for we must remember, that if a farmer fails in the use of a competitor's brand, it indirectly hurts the sale of our own brand. Common directions will help individual manufacturers as well as the industry as a whole. This is a kind of co-operation in which the industry should engage.

I believe we should urge uniform State laws to govern the sale of fertilizers, or, if not uniform laws, then a uniform and also a simplified statement of analysis. I would only give the minimum guaranty and reduce the statement to four items: nitrogen, available phosphoric acid, total phosphoric acid and potash. This would greatly simplify business. I believe also that we should urge uniform and up-to-date methods of testing fertilizers, and should heartily co-operate with State officials in all reasonable efforts in this direction.

Co-operation with All Agencies

We must also co-operate with and encourage scientific investigation in our particular field relating to the composition, manufacture and use of plant foods. Such experiments as those which have been conducted for years in Massachusetts, Rhode

Island, Ohio, Pennsylvania and a score of other States, are of enormous value to us. Never mind if some of them seem to be against us, or are construed against us by pseudo scientists. Don't let that worry us. I have read diatribes by learned doctors against the use of milk, potatoes and white bread as food; but milk, potatoes and white bread will be used as human food just as prepared chemicals will be used for plant food.

Within a short time there will be at least three thousand county agents in the employ of the Federal and State governments—men whose business it will be to make a house-to-house canvass among farmers, seeking to assist them in their work. As far as possible we should co-operate with these county agents and with all the agencies which are to be employed for the up-building of agriculture and the uplift of the farmer, for remember, as he thrives, we thrive. He is our only customer. It has been stated that there will be no less than fifty million dollars expended annually in this country in this sort of work. We pay our share of it. We should share in the benefits.

Advertising the Industry

I have also been asked by President Jarecki to say a word about advertising. Now that is a large order. I have been advertising my particular wares for many years. For the first four years I was foolhardy enough to spend all I made in advertising, *but it paid*. I would advertise extensively, especially in all new sections. There is no industry which offers a wider scope. Aside from the sciences involved each crop affords a theme. Corn, tobacco and roses require different treatment, but all require plant food.

We are obliged by law "to state what we sell and to sell what we state." No other products are so thoroughly and conscientiously inspected in every State as are fertilizers. If up-to-date methods of analysis are employed, as is the case in most States, the farmer can know just what he is getting in availability as well as in strength. The official inspectors are conscientious and trustworthy. Good inspection insures confidence, therefore we should encourage it and make the most of it in our advertisements. We should also see to it that our goods are well made chemically and physically, for it is needless to say that such goods advertise themselves.

Fertilizers intended to be used for starting crops and improving quality should have a part of their nitrogen in chemical form and a part in organic form, one to start and one to help later maturity—and the phosphoric acid should be available—as much of it water soluble as possible and preserve good physical condition, for remember, fertilizers are to be applied more and more by machine, therefore they must be "dry and drillable."

A good start at the drill is the best kind of an advertisement. The drill is our best friend.

Our advertisements, either in our literature or in the press, should contain nothing of an exaggerated or mystic nature. There is no secret or mystic property in fertilizers. We should not appeal to the credulity of the consumer. Leave that to the demagogue. Our statements should be based on the best practice and should be clean-cut and absolutely truthful.

The Future of the Industry

Finally, if we are progressive and outspoken we have little to fear. Many industries have been subject to special and oppressive legislation; so far ours has escaped. I have seen our industry unfairly criticized in many quarters, but I have also seen it grow to enormous proportions. Honest criticism never hurt anyone, and abuse from some quarters is helpful. The true scientist, the broad economist and the wise statesman are with us and for us. What is more important, the practical, hard-headed commercial farmers are with us and will stay with us if we strive intelligently and faithfully to serve them.

Sir John Lawes was the father of the modern fertilizer industry. He took out his patent for "superphosphate" in 1842, and later founded the Lawes Manure Company of London, always, and still, a large, successful company. He founded and supported at Rothamsted an experiment station to experiment with fertilizers in order to know what to make and sell. The industry has followed his teachings. He associated with him an able chemist, Dr. J. H. Gilbert. They conducted and reported their experiments so fairly that the world accepts them as authoritative. They were both knighted for their distinguished and faithful service. They put the industry on a high business and scientific plane. Let us keep it there.

So, as one of the oldest men engaged in the industry, let me say to you younger men: Dignify and honor the industry by carrying it on in a dignified, upright, progressive way, and you will see it one of the largest and most respected industries in the country.



ADDRESSED TO THE FARMERS OF THE EAST AND SOUTH,
AND, IN THE NEAR FUTURE, TO THOSE OF THE WEST.

THE SPIRIT OF THE LAND: *"I have fed you all these ages. You must feed me now!"*

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